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Space Exploration Program

A ten-year space exploration program remarkably similar to that proposed by the Jet Propulsion Laboratory (SCIENCE TRENDS, Sept. 14, 1959) has now been adopted by the National Aeronautics and Space Administration. Tentative plans call for approximately 260 launchings over the next decade.

Space Politics: NASA discarded its long-stated reluctance to announce future launching plans in a determined effort to demonstrate to Congress that an ambitious program is in the works. NASA officials feared that unless this could be done the pressure in Congress to revamp their agency, perhaps to establish an Atomic Energy Commission for Space, would be irresistible in an election-year atmosphere. The 10-year program announcement represents an extreme effort to reverse this process.

Space Funding will have to be vastly increased to keep the announced program on schedule. There will be a new appropriation request of approximately $100 million shortly, chiefly to cover a speed-up of the Saturn space booster program. Officials predict that next year NASA will ask for more than $1 billion, with the figure rising to more than $1,500 million a few years later. Plans now indicate that the present variety of first-stage boosters will be reduced by Fiscal Year 1962 to the solid propellant Scout and the Thor, Atlas and Saturn. There is a possibility that the Thor may be eliminated from the program earlier than the chart below indicates.

NASA Anticipated Major Launching Schedule by Vehicle

FISCAL YEAR	1960*	1961	'62	'63	'64	'65	'66	'67	'68	'69
Redstone	1	2 3 2								
Atlas	1	2 1 2 1	6	1						
Juno II	1	1 3								
Thor-Able	2									
Atlas-Able	1	1								
Scout	4	2 2	6	6	6	6	6	6	6	6
Thor-Delta	1 1	1 2 1 1	5							
Thor-Agena B			1	6	6	6	6	6	6	6
Atlas-Agena B		1	3	4	5	6	3)	12	12	12
Atlas-Centaur		1	5	4	5	6	9)			
Saturn			2	2	3	4	4	4	4	4
Nova Type									1	2
TOTAL	12	29	28	23	25	28	28	28	29	30

* Last Two Quarters Only

Basic Ordnance Research

The Office of Ordnance Research intends to place some $5 million in research funds on basic studies in five general areas of military and scientific interest.

OOR officials intend to "look with extra interest" at any proposal relating to:

* Radiometry

* Ceramics as a Structural Material

* Corrosion

* High-Power, High Response Speed, Solid State, Controls

* New Materials from High-temperature and High-pressure Processes

Other examples of military themes of immediate interest to the Army Ordnance Corps, as listed by Dr. Sherwood Githens, Deputy Chief Scientist, OOR, Box CM, Duke Station, Durham, N.C., are:

* Methods of predicting how great the effects may be upon the extreme upper atmosphere when an atomic weapon explodes there, and how long these effects will persist.

* Methods of predicting, in the presence or absence of an atomic explosion, to what degree electromagnetic-wave radiation will be attenuated, reflected, or refracted, at different altitudes and under various conditions.

* Determination of the radiation of all frequencies produced by shock waves associated with hypervelocity objects.

* Detailed information about the plasma sheath associated with hypervelocity objects, and the interaction of electromagnetic radiations within this sheath.

* Exploration of physical properties to aid in distinguishing between an incoming warhead and other objects that may accompany it.

* Means to probe a laboratory-created plasma so that the conditions at a particular point can be determined.

* Exploration of all conceivable means to generate microwave energy at megawatt levels, and antennas that will direct such power.

* Switches for large amounts of electrical power that can operate in a few microseconds with no moving parts and without hazardous sparks or arcs.

* A cell that will efficiently convert the energy of a gas or gases into electrical energy without generating much heat and without motion.

* Studies to find a data processing system most appropriate for anti-missile defense work, perhaps using the classical theory of analytical mechanics for reduction of information.

New Radar Test Target System

National Aeronautics and Space Administration (NASA) has developed and tested a new system for launching inflated test targets for use in research, development and evaluation of radars -- particularly those of long range. The system is said to have a number of advantages.

*Launching Systems: Two systems were developed for various payloads and missions.

Three-Stage Launcher was developed to carry a 30-inch Mylar and foil inflatable sphere to any altitude up to a maximum of 150 statute miles. First stage is an M5 JATO Nike booster solid-propellant rocket motor. Second stage is a 6.25 inch solid-propellant Cajun rocket. A novelty is the plastic third stage designed to minimize extraneous radar reflections. Third-stage nose is made of nylon, with a body cylinder of fiber glass and Paraplex. Other parts and sections are constructed of phenolic resin, Bakelite, fiber glass cloth and tape and an epoxy resin. Nozzle is made from boron nitride, a nonmetallic, poor-conducting, high temperature material and is encased in a mahogany sleeve. A so-called "jelly roll" igniter was used with Thiokol T-13E1 propellant.

Sphere ejection is accomplished through a simple "slingshot" arrangement. Target and inflation bottle are housed in a piston-type mechanism made from impregnated mahogany. The piston rests in the nose of the rocket on a balsa disk, which is held by two strips of rubber in tension.

Two-Stage Launcher is composed of a Nike-Cajun combination and a nose section and is used for spheres of 12 feet diameter. No plastic stage was found to be required because of the large radar cross section compared with the booster components. Target is housed in the nose section held to the second stage by a metal or "marmom" band which is separated by a timing mechanism and explosive bolt arrangement. A steel spring then produces a 75 pound separating force. Target is then released from the nose section by means of a bellows.

*Results: Flight tests are said to indicate that both versions of the system are adequate for placing the radar targets at desired altitudes. Targets of other sizes are said to be feasible and further staging can be used to achieve increased altitude where desired.

In addition to the testing of radars the system is said to be of possible value in investigation of the path-propagation characteristics between the ground and objects within or above the ionosphere.

(R&D by James T. Rose and R. Donald Smith, Langley Research Center, NASA, Langley Field, Va.)

Missile Instrument Packages

Six new instrument packages are under development for the Air Research and Development Command for "hitchike" missions aboard the Atlas ICBM. The new packages weigh 60 pounds including power supply and telemetry. Packages, early versions of which were flown last year, will probe for gamma and x-rays, electrons, protons and neutrons, as well as "other electromagnetic radiations." The 1959 versions reached altitudes of between 700 and 900 miles. Separation is by means of a timer-signal and explosive bolt arrangement.

The Radarfax - A new Meteorological Instrument

The Naval Research Laboratory has developed the Radarfax, a new meteorological instrument which is designed to increase the use of weather radar by forecasters. The instrument is said to simplify this process by making it unnecessary for the forecaster to watch the radar scope to observe changes in weather patterns.

Development: Researchers decided that for meteorological interpretation the standard PPI (Plan Position Indicator) would have to be supplemented by CAPI (Constant Altitude Position Indication) and RHI (Range Height Indication) and provision was made for this type of data.

A rotary facsimile printout was devised in which an antenna elevation control is incorporated in the facsimile stylus advance mechanism. This technique is said to provide automatic control of elevation versus range, thereby permitting a CAPI readout for an altitude chosen.

As antenna elevates, an automatic stylus advance corrects for the difference between slant range and horizontal distance. This is said to permit a printout display carrying little distortion from a true horizontal position indication of the precipitation or weather pattern at the altitude chosen.

Printout signal comes from a photocell which slowly scans across in the radar "A" or "B" Scope. One complete printout is accomplished in 100 revolutions of the antenna and facsimile paper. Development work is being carried out to include Range Height information, and to make the unit suitable for remote facsimile recording over telephone lines.

(R&D by Atmosphere and Astrophysics Division, Aerology Branch, U. S. Naval Research Laboratory, Washington 25, D.C.

Physics-Chemistry Study

Massachusetts Institute of Technology has received $599,200 in grants to study properties of some lesser-known ferromagnetic, ferroelectric and organic materials. The nature of various low-temperature phase transitions, such as changes in crystal structure, will be studied under a $399,800 grant from the National Science Foundation. This work will include measurement of specific heat anomalies, x-ray and neutron crystal structure studies, and the use of nuclear magnetic resonance techniques. Elastic properties and nature of the chemical bondings in selected materials will also be investigated from both a theoretical and experimental approach.

A companion grant of $199,400 from the Air Force Office of Scientific Research will support studies of the crystallographic and magnetic phenomena in various materials with a polarized beam neutron spectrometer.

(Investigations to be directed by Dr. John C. Slater, Director, Laboratory of Chemical and Solid State Physics, M.I.T., Cambridge, Massachusetts)

Research Checklist

( ) Transistorized Alpha Counter: Researchers at the Oak Ridge National Laboratory have designed and developed a transistorized portable alpha scintillation counter. Test results are described as "gratifying," in terms of reliability and stability. Circuitry consists of a feed-back amplifier pair, a trigger pair which functions as a discriminator, a scale of 2, a pulse shaper and register driver, a regulated supply for the photomultiplier and a built-in battery charger.

(R&D by Instruments and Controls Division, Oak Ridge National Laboratory, Oak Ridge, Tenn.)

( ) Satellite Attitude Control: Studies at the NASA Langley (Va.) Research Center indicate that relatively lightweight stabilization systems can meet most of the orientation requirements for presently planned satellites. The analysis is said to demonstrate that an improved version of spin stabilization incorporating earth-horizon scan units is attractive for certain meteorological payloads, while gravitational-gradient methods may be attractive for large satellites.

(Report available. 79 pages. Single copies free. Write NASA, 1520 H Street, N.W., Washington 25, D.C. Attn: CODE BID, for Technical Note D-40)

( ) Aircraft Landing Assembly: Studies by Bendix Aviation Corp for the U.S. Air Force conclude that it seems feasible to design a wheel, brake and tire for aircraft capable of operating from an ambient temperature of 800° Fahrenheit although a good deal more study is required. The most challenging approach was said to be development of a mechanical tire, and tread material to replace the conventional rubber tire. The study includes a literature and industrial survey in such fields as tires, bearings and lubricants and hydraulic or pneumatic seals.

(Report of May 1959 now available. 78 pages. $2.25. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for WADC Technical Report No. 59-210)

( ) Low-Temperature Seals: Preliminary studies indicate that natural rubber affords the most promising seals for application at temperatures of minus 120° Fahrenheit and below. The survey, by the National Bureau of Standards, is expected to help determine superior types of leak-proofing in missiles, rockets and ground-support systems using liquified gases. Studies are being made of the possibility of fabricating low-temperature seals by squeezing so-called O-rings into the shape of thin circular gaskets.

(R&D by Cyrogenics Processes Section, National Bureau of Standards, Boulder, Colo.)

Publication Checklist

( ) Nuclear Weapons Capabilities, a world-wide survey written for the National Planning Association warning that it will soon be impossible for major powers to control the spread of nuclear weapons. 42 pages. $1. (Write National Planning Association, 1606 New Hampshire Avenue, N.W., Washington 9, D.C. for Planning Pamphlet #108)

( ) Iron Ore Resources, a new compilation of total domestic iron-ore resources of the United States. The new total, estimated at 75 billion long tons of crude ore, is considerably higher than earlier estimates. 75 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Geological Survey Bulletin 1082-C)

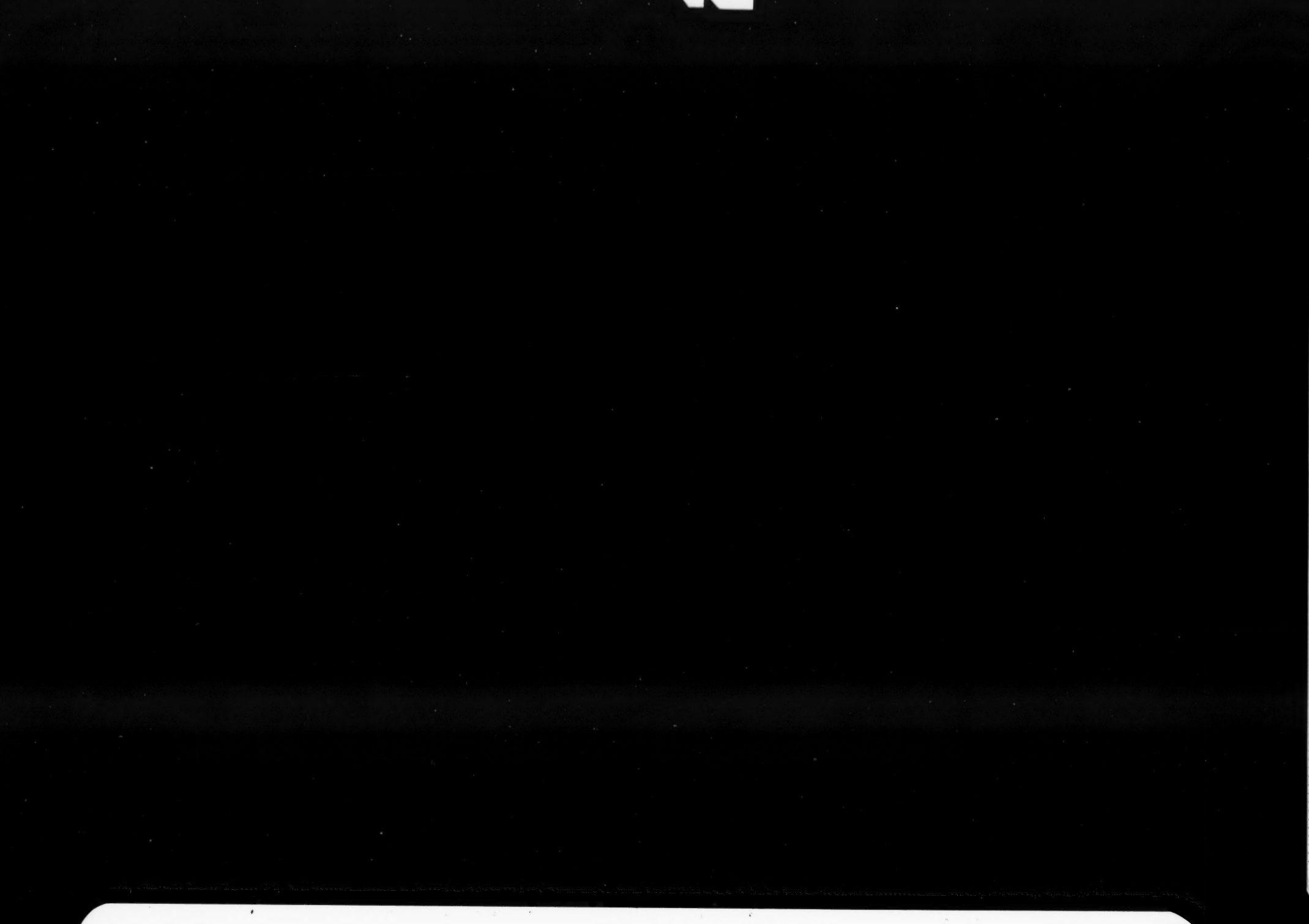
( ) Photogrammetry, a 1959 survey by the Highway Research Board with the emphasis on new developments and applications. 69 pages. $1.20. (Write Publications Office, National Academy of Sciences, Washington 25, D.C. for Highway Research Board Bulletin 228)

( ) Protective Steel Coatings, a Government bulletin on protective coatings for steel construction with the emphasis on neoprene applications. 4 pages. Single copies free. (Write Service Department, Washington SCIENCE TRENDS, 1120 National Press Bldg., Washington 4, D.C.)

( ) Soviet Gas-Turbine Steels, a U.S. Government survey of Russian literature on the characteristics, coding and classification of Soviet high-temperature steels, mainly those used in gas turbines, 17 pages. 50 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Report 60-21016)

( ) The Ephemeris, the 1960 edition of the astronomical almanac issued annually by the U.S. Bureau of Land Management for the use of its cadastral engineers. 30 cents. (Write Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. for The Ephemeris, 1960)

( ) Rare Earth Chloride Solutions, a description of a chemical process for preparing solutions of trivalent rare-earth chlorides from sulfate solutions obtained by treating bastnasite concentrate. 10 pages. Single copies free. (Write Publications-Distribution Office, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa., for Report of Investigation 5540)

( ) Explorer VII, the transcript of a Government press conference including information on the satellite project background and experiments. 51 pages. Single copies free while available. (Write NASA, 1520 H Street, N.W., Washington 25, D.C. Attn: Press Information Office for Transcript - Explorer VII Press Conference, Dec. 30, 1959)

( ) Plastics, a world survey sponsored by the U.S. Department of Commerce which concludes that the U.S. is the world leader in the plastics industry, and domestic operations are being supplemented by an expanding foreign program. $1. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for World Survey of Plastics -- 1954-1957)